



Spark Gap

Vol. 38, Issue 10, October 2021 *MARC - Serving Central Indiana Communities for thirty-eight years*

On Our MARC:

This Saturday, October 16, at 8 am we will be holding our monthly MARC meeting at New Hope Church, 5307 W Fairview Rd Greenwood IN 46142 - on Fairview just west of Morgantown road. We will meet in the Youth room, which is the room we have used in the past on the upper level. The audio portion of the meeting will also be carried on the Club's 2M repeater as we have done in the past. Due to the difficulty hitting the repeater directly from this location, we will cross-band repeat using our own HT radios on UHF to my vehicle in the parking lot of the church to relay our HT signals to the MARC 2M VHF repeater. If you plan to attend in person, **please bring an HT programmed for the Simplex frequency 445.875 MHz (no PL tone) to use when you speak at the meeting** so repeater only listeners can hear.

The guest speaker this month is Bill McAlpin, WD9GIU, who will go before the business portion, and will talk about working with the youth in the community and club building. He will have slides so will not transmit on 2M. We will resume transmitting after the presentation.

73,
Tim
WC9G



Bill McAlpin, WD9GIU our speaker for this month. Bill has been a HAM for over twenty five years and has been active in his community as well as his local radio club. Bill has worked with schools in the Peru area and has made it possible for school children talk to the astronauts in the International Space Station. His wife Michelle, WD9JOY is also a licensed HAM.





Birthdays the Month of October

KB9JMU - J im Adams
N9KYC - John Brooks
KC9NJM - Bob Jones
KD9FBC - Wilson Low
K0CMD - David Nienhauser
KN9C - Rudy Richardson
KM9S - Darrell Sego
AF9SE - Steve Ellis



It's that time of year.

Mid-State Amateur Radio Club Inc.
P.O. Box 836
Franklin, IN 46131



2021 October Historian Snapshot

15 Years Ago (2006)

- J. R. Osborne (KB9HSE, SK) was the newly elected President. He welcomed 18 club members attending.
- Duane Straw (KC9ESH) talked about the Hilly 500 bicycle race in Bloomington.
- Paul Hise (AA9YG, SK) reported that pictures were being archived in the radio room.
- Joe Rogers (KF9LQ, SK) donated a tower to the Red Cross of Johnson County.
- A spring 2007 technician class was in the planning stages.
- The Spark Gap had photos of club members working the Greenwood High School Band Contest.

10 Years Ago (2011)

- Bob Jones (KC9NJM) was the newly elected president. He welcomed 13 club members attending.
- Several boy scouts getting ready for JOTA activities also attended the meeting.
- Bob updated club members on the upcoming Goblin Patrol event.
- Presenters were Marc Snell (KC9CCM) and Dennis Snell (KC9 CCO) updating the club on the ARRL equipment review process. Their presentation was followed by a You Tube ® video on JOTA.
- Bob thanked Steve Brown (N9LC) and his wife for hosting our September picnic.
- The Spark Gap had photos of both the Greenwood High School Band Contest volunteers and our September picnic attendees.

5 Years Ago (2016)

- Jacki Frederick (KI6QOG) was president. She welcomed 27 club members to the meeting.
- Thanks were given to Chris Frederick (KQ9Y), Mike Rose, Steve Carmean (K9DY), and many others who helped get our new radio room up and running in time for the Goblin Patrol.
- Bob Jones (KC9NJM) reported on the ARES Set conducted on October 1st.
- Bob LaGrange (N9SIU) reported on the Greenwood High School Band Contest.
- Dave Daily (KB9LOT) reported on the just completed RACES District 5 & 9 exercise. He also updated the club on getting wiring in the radio room for our computer.
- JOTA info along with dinner social reservations were listed in the Spark Gap. Also included was a report on our APRS class, along with class photos.

Respectfully submitted by,
Linda Harshbarger, KC9GCH
Club Historian

Club Sizzles in September

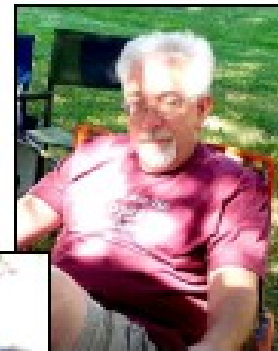


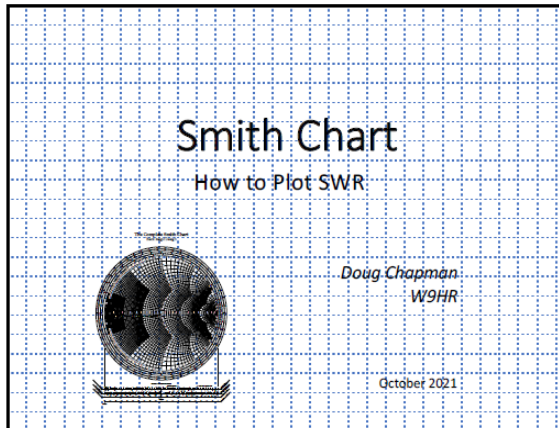
September 18th brought sunny skies, warm temps and dozens of MARC members to Independence Park for our annual cookout. Club President Tim WC9G brought his charcoal grill and put the hamburgers and hotdogs to the sizzle test.



Club members filled the serving table with dozens of delicious side dishes like baked beans,

potato salad and cheesy potatoes just to highlight a few. Ron K9THR brought the official MARC Ballot Box stuffed with members choices for new 2021-2022 club officers. The final count showed Tim Aldridge WC9G elected president, Rhonda Curtis WS9H -vice president, Jim Adams KB9JMU- secretary and Jackie Frederick KI6QOG as treasurer. Photos/story by Jack w8ish





Smith Chart Background

- Invented circa 1939 by Phillip Smith at Bell Telephone Labs (now Bell Labs)
- Dominant tool used by microwave engineers WWII until development of digital computers
- Without Smith Chart, mathematical calculations were cumbersome because they were done by hand (no calculators or computers)
- Smith Chart made calculations relatively easy using simple plots

What is SWR?

- Sometimes called VSWR
- Voltage Standing Wave Ratio
- Measure of matching loads to the characteristic impedance of the transmission line (50Ω in our case)
- Incident wave is the forward wave to the load (antenna)
- Reflected wave travels back towards the source (rig)
- When there is an impedance mismatch along the network, a standing wave is created
- This is called an "unmatched network"
- The standing wave interferes with the power to the load
- 1:1 is perfect but unrealistic
- 2:1 and below generally is acceptable

Impedance

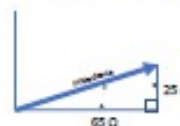
- Impedance is a measure of the resistance of the load
- Impedance is measured in Ohms
- A coax cable has a characteristic impedance of 50 Ohms
- Resistance occurs when there is a hindrance of electrical flow within a conductor
- Reactance: Opposition to the flow of AC caused by capacitance or induction.
- Impedance is a combination of resistance and reactance
- Reactance is not simply added to the Resistance

How to Calculate Impedance

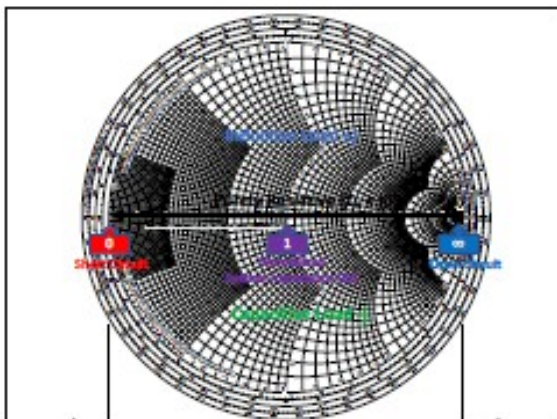
- Resistance and Reactance can't simply be added together
- Complex math must be used
- $Z_0 + jX$ (complex number)
 - Z_0 = Resistance (real number)
 - jX = Reactance (imaginary number)
- Let's take an example to illustrate

Impedance Example

- A load has
 - 65 Ω (pure resistance in Ohms)
 - 35 L (inductance Henrys)
 - 10 C (capacitance in Farads)
- What is the Impedance?



- Plot resistance on X axis
- Calculate net L or C and plot on Y axis
 $-10C + 35L = +25L$
- Calculate Hypotenuse Length
 $\sqrt{65^2 + 25^2}$
 Impedance = 69.64

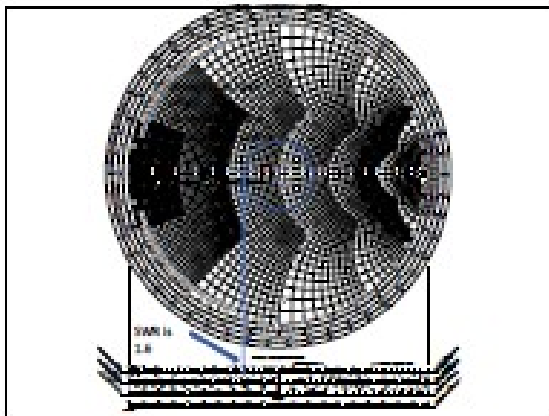
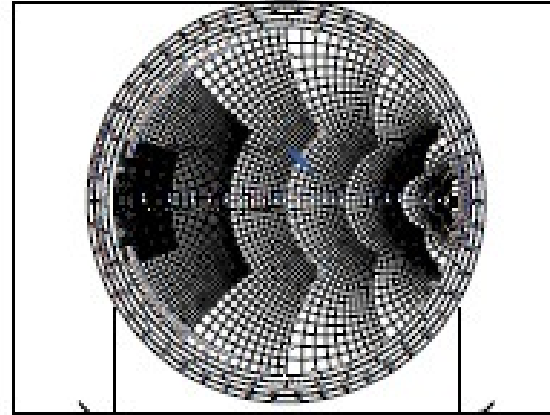
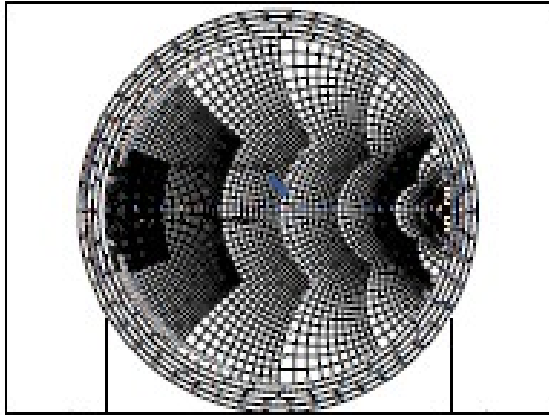


Smith Chart Step 1 Normalize Impedance

$$65 + j25$$

Divide by coax characteristic resistance $\rightarrow \frac{65}{50} + j\frac{25}{50}$

Impedance normalized for Smith Chart $\rightarrow 1.3 + j0.5$



Let's Prove it Mathematically

Reflection Coefficient

The ratio of the voltage in the reflected wave to the voltage in the forward wave at the same point.

$$|\rho| = \frac{\sqrt{(R_1 - R_0)^2 + X_1^2}}{\sqrt{(R_1 + R_0)^2 + X_1^2}}$$

SWR

The ratio of the amplitude at the antinode (maximum) of the standing wave to the amplitude at the node (minimum).

$$SWR = \frac{1 + \rho}{1 - \rho}$$

Let's Prove it Mathematically

Reflection Coefficient

R_0 = Line characteristic resistance (real) = 50Ω

R_L = Load resistance (real) = 65Ω

X_L = Load reactance (imag) = 25Ω

$SWR = \frac{1 + 0.248}{1 - 0.248}$

$SWR = 1.66$

$|ρ| = \frac{65 + j25}{\sqrt{(65+50)^2 + 25^2}}$

$ρ = 0.248$

Bonus: What's the Phase Angle?

- Remember ELI the ICEman
 - ELI – voltage leads current
 - ICE – current leads voltage
- In our example, we have an inductive circuit so voltage leads current.

Phase Angle

SOHCAHTOA

$\sin^{-1} \frac{\text{Opposite}}{\text{Hypotenuse}}$

$\sin^{-1} \frac{25}{57.26}$

Phase Angle = 23 degrees

Phase Angle - ELI

Current lags behind voltage

Wait, we're not done yet.
Let's calculate frequency at resonance

$f_{\text{reson}} = \frac{10^9}{2\pi \sqrt{LC}}$

$f_{\text{reson}} = \frac{1000}{2\pi \sqrt{0.000001 \times 10000000000}}$

$f_{\text{reson}} = 0.5$

From Our Example

When L = 80 and C = 10, the resonant frequency is 0.5 MHz.

Additionally, when Z=0 the SWR is 1.66.

W9MID Repeater Considerations and Open Discussion

W9HR
Doug Chapman
August 21, 2021

Topics for Discussion

- Johnson Country Communications Coverage
- Repeater Availability
- YSF/WIRES-X

Johnson County Communications Coverage

- 2021 Club S.E.T. Simulation Exercise Notes
 - Repeater Communication Worked For Most Locations
 - With No Repeater, Communication Was Limited
 - Simplex Communication Was Spotty
 - Communication from SW Johnson Country is Weak
 - As Official SkyWarn Repeater for JC, Full County Communication Coverage is Important

Repeater Availability

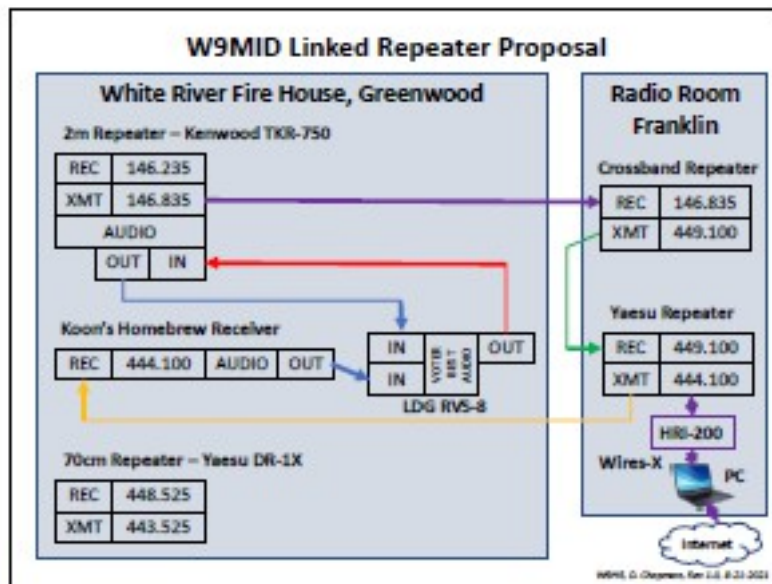
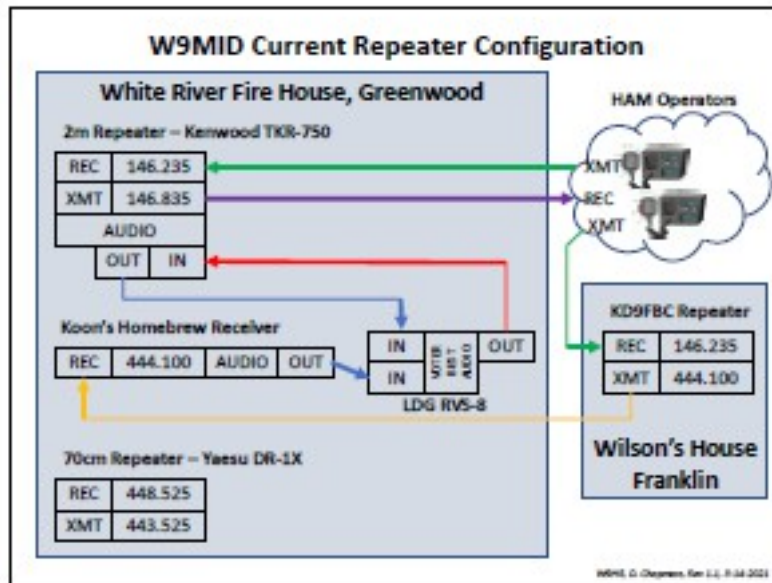
- Failures That Affect Availability
 - Electro/Mechanical
 - Power
 - Site Disaster (Tornado, Flood, etc.)

Repeater Availability

- How Prepared Are We?
 - ✓ • Electro/Mechanical
 - ✓ • Power
 - ✗ • Site Disaster (Tornado, Flood, etc.)

YSF/WIRES-X

- YSF Radios Becoming Increasingly Popular in Club
- WC9G Has WIRES-X Working With W9MID Backup Repeater
 - Relies on WC9G personal equipment and Internet
 - Backup Repeater Not Reachable From All JC Locations
- W9MID Club WIRES-X Connection Desirable



Why Consider This Proposal?

- Increases JC SkyWarn Repeater Availability
- Increases JC Communication Coverage
- Adds Club YSF/WIRES-X Availability

Equipment Needed

- Yaesu DR-1X or DR-2X Repeater
- 19 Inch Rack
- HRI-200
- Cross Band Repeater Radio
- Duplexer
- PC
- Battery Backup?

..... Thanks to Doug, W9HR for his thoughts on this proposal.

2021



Save the date!

FORT WAYNE HAMFEST

November 13-14



MID-STATE AMATEUR RADIO CLUB

The Mid-State Amateur Radio Club meets the **THIRD SATURDAY** of each month
at the **Johnson County REMC 750 International Drive Franklin, IN 46131.**

(When Normal Returns)

See our website, www.midstatehams.org, for maps on how to get to our meeting.

Everyone is welcome; you do not have to be a *HAM* to attend our meetings or a member of the club.

W9MID Repeater:

146.835/
146.235 MHz
(151.4 Hz PL Tone)

Club Officers:

President: Tim Aldridge - WC9G
Vice President: Rhonda Curtis - WS9H
Secretary: Jim Adams – KB9JMU
Treasurer: Jacki Fredrick - KI6QOG
Repeater Trustee - Chris Frederick – KQ9Y

W9MID Repeater:

443.525/
448.525 MHz
(151.4 Hz PL Tone)

Weekly Net: Sunday evening 7:00 PM ARES/RACES members and ALL RADIO AMATEURS
146.835/146.235 MHz (151.4 Hz PL Tone)

The Official Newsletter of the Mid-State Amateur Radio Club

P.O. Box 836
Franklin, Indiana
46131

Spark Gap Editor: Robert LaGrange N9SIU

Please send your articles to my email: n9siu@yahoo.com no later than the 2nd week of the month.



Thanks to the New Hope Church for the use of their building for meetings and testing.